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Travis

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(54) **UTILITY MINE SCOOP AND MINE DUSTER**

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E01C 19/20 (2006.01)
E21F 13/02 (2006.01)
E21F 5/10 (2006.01)

(52) **U.S. Cl.**
CPC .. ***E21F 13/02*** (2013.01); ***E21F 5/10*** (2013.01)

(58) **Field of Classification Search**
CPC E01C 19/20
USPC 239/673, 661, 675, 676, 682, 687, 689, 239/664, 681; 222/252, 254, 272, 273, 330, 222/331, 334; 414/495, 497, 517; 118/305, 118/312, 313, 315
See application file for complete search history.

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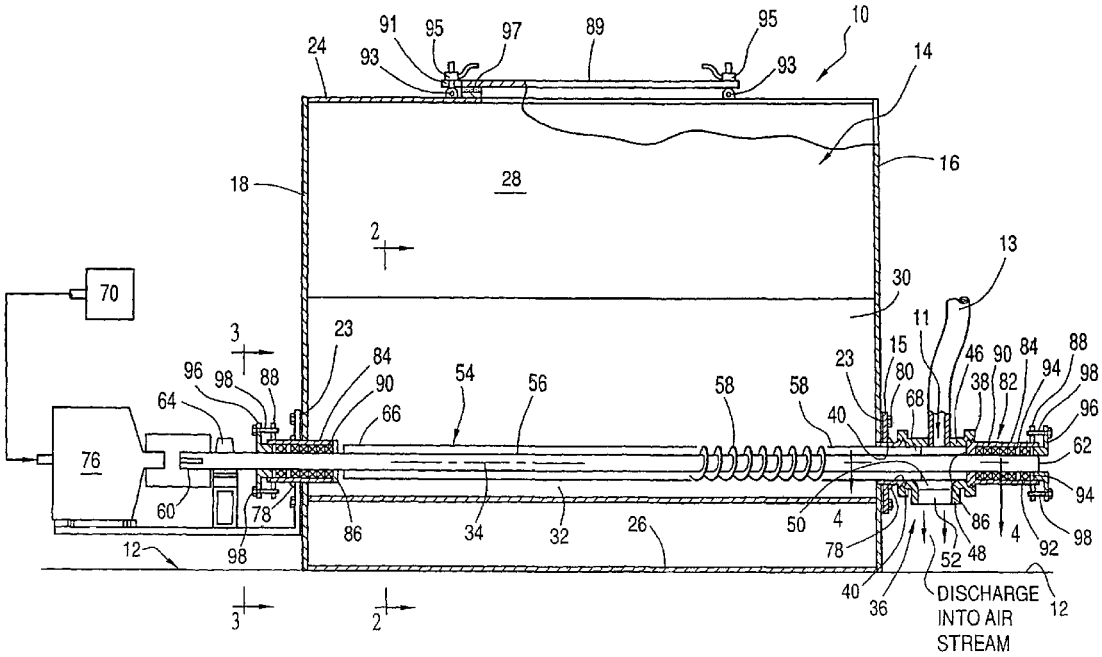
Primary Examiner — Justin Jonaitis

(57) **ABSTRACT**

A mine scoop machine having a steerable wheeled body provided with a material scoop having a load ejection blade mounted thereon for movement longitudinally of said body between a load position and a load ejection position adjacent an open front end of the scoop, operator controlled power means for moving the ejection blade selectively between the two positions for loading and unloading the scoop, a mine dusting unit mounted on the body rearwardly of the load position of the ejection blade, wherein the dusting unit comprises a dust hopper having a ground rock material feed inlet port and a rock dust outlet port, an air jet means on the unit for fluidizing the ground rock material and ejecting the resulting rock dust out into a mine shaft.

7 Claims, 8 Drawing Sheets



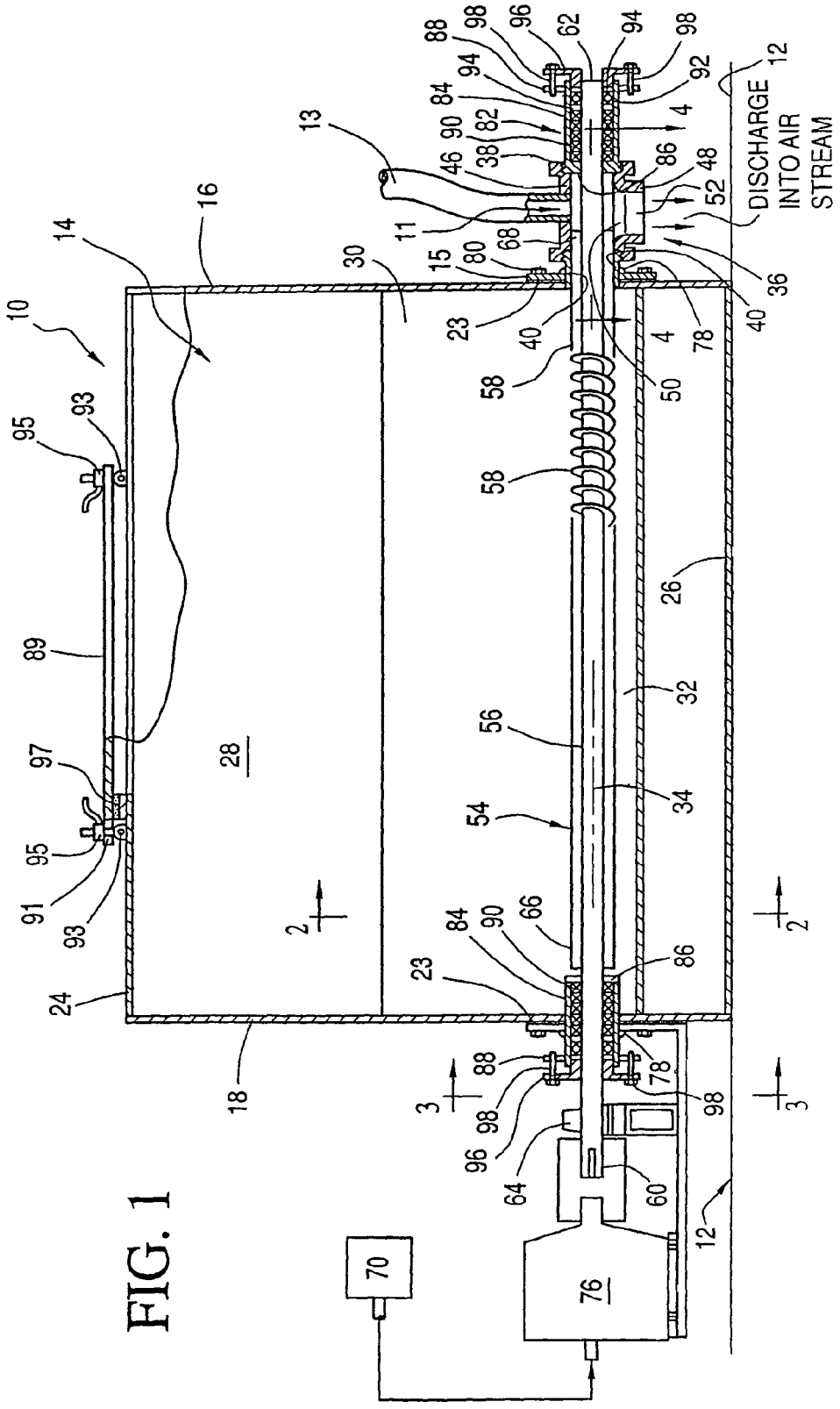

DISCHARGE INTO AIR STREAM
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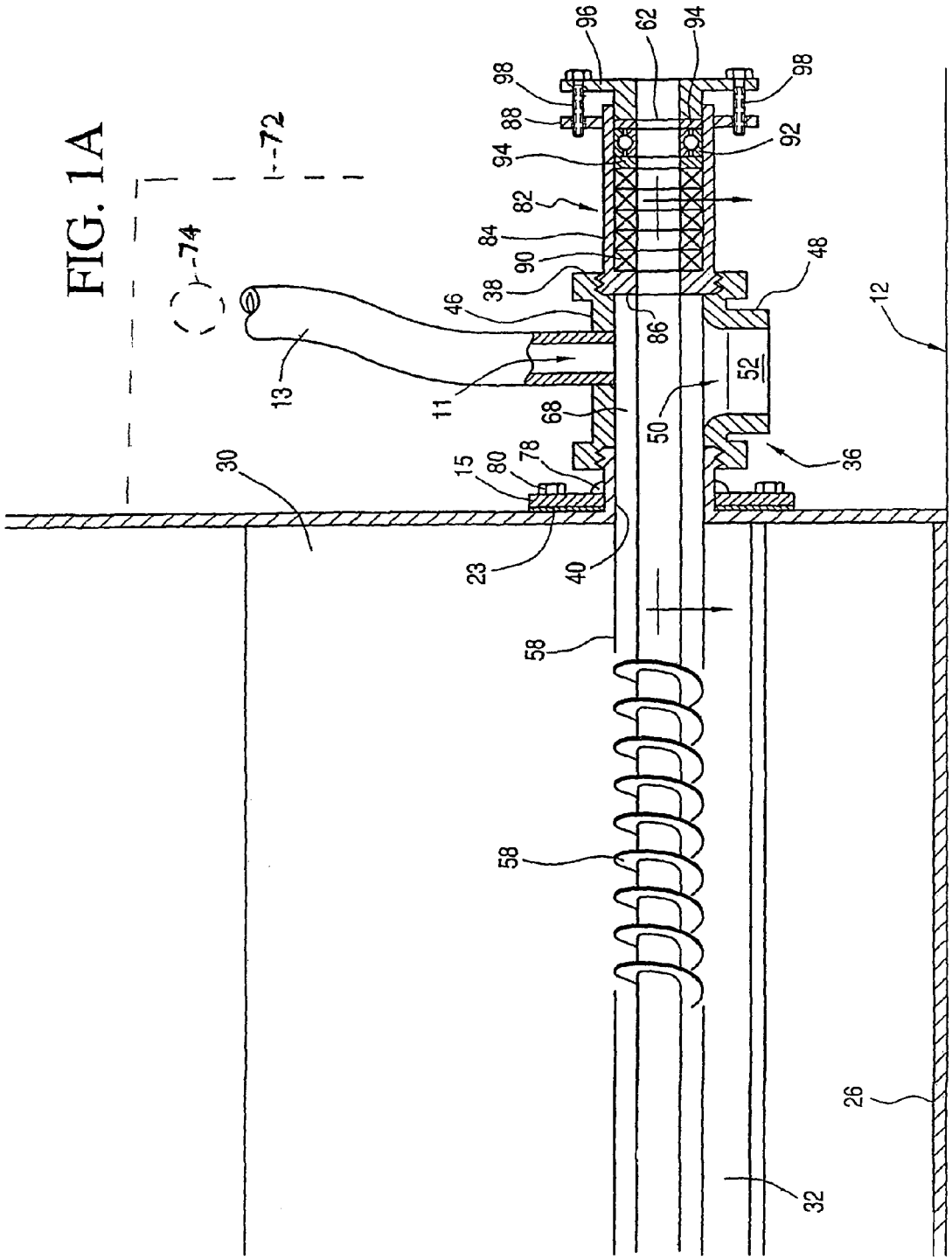
FIG. 1

FIG. 1A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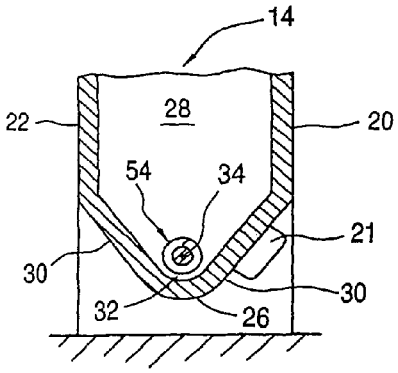

FIG. 2

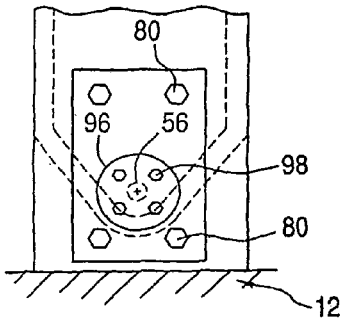

FIG. 3

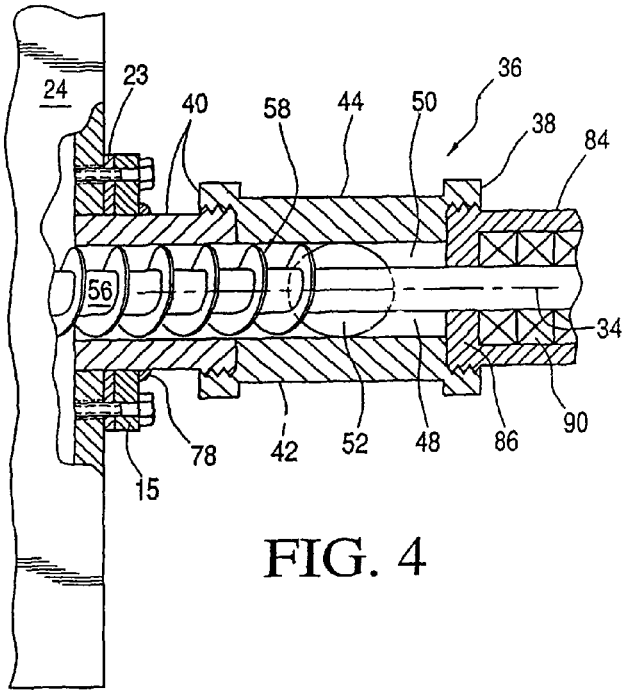

FIG. 4

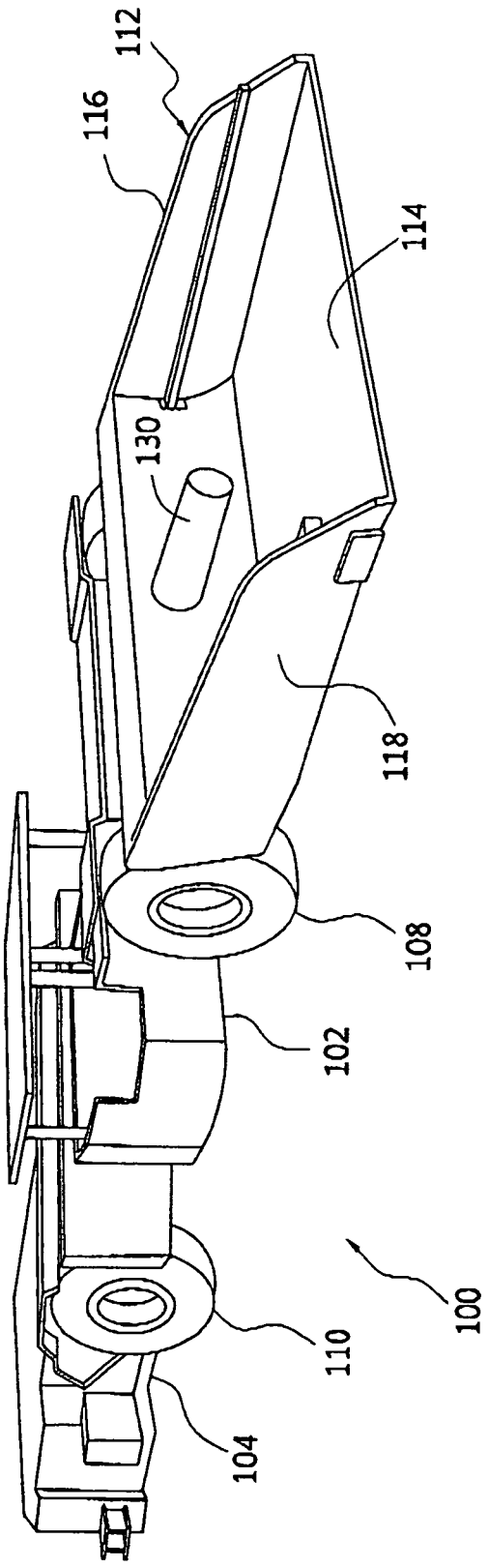

FIG. 5

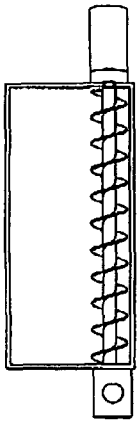

FIG. 6A

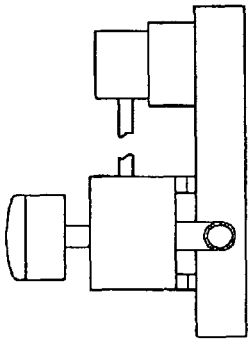

FIG. 6B

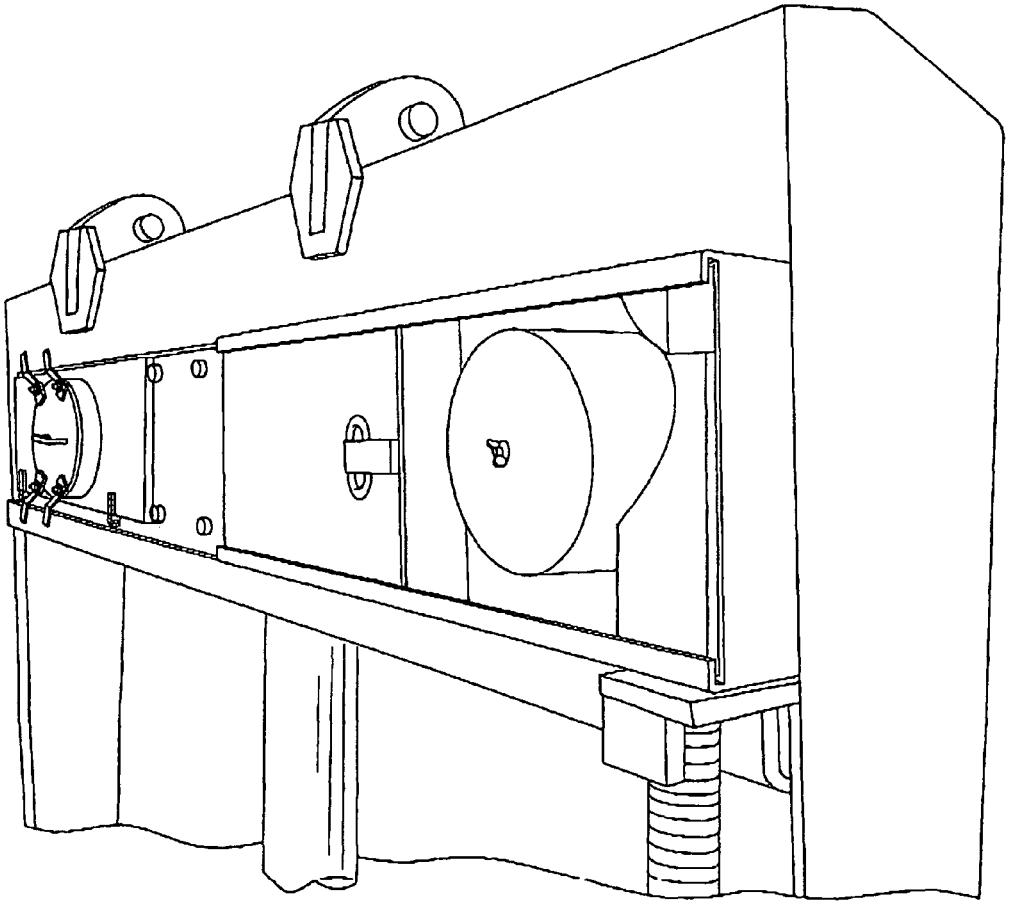

FIG. 6

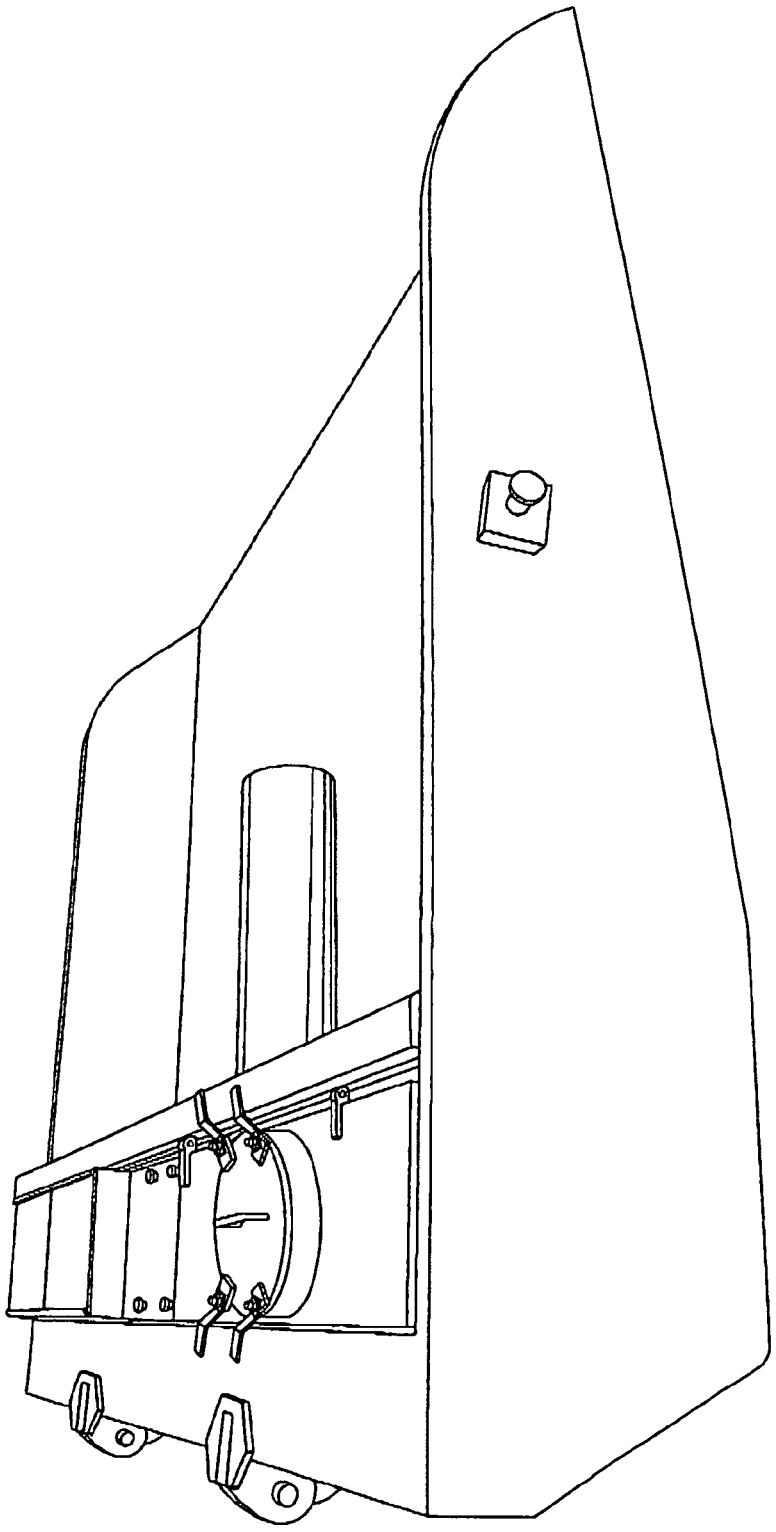

FIG. 7

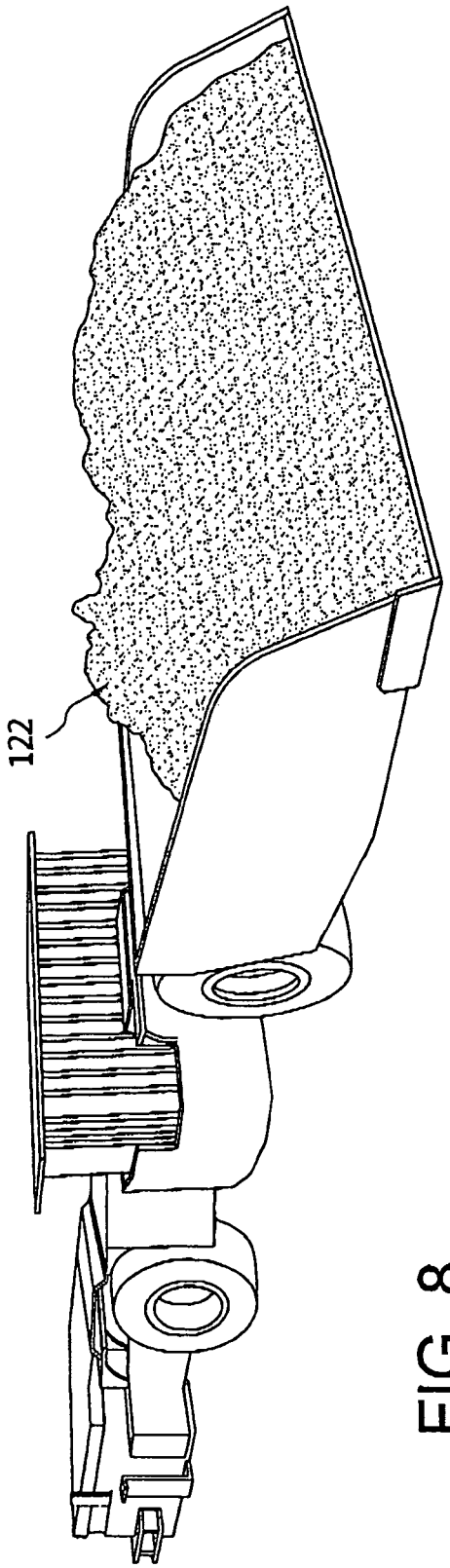

FIG. 8

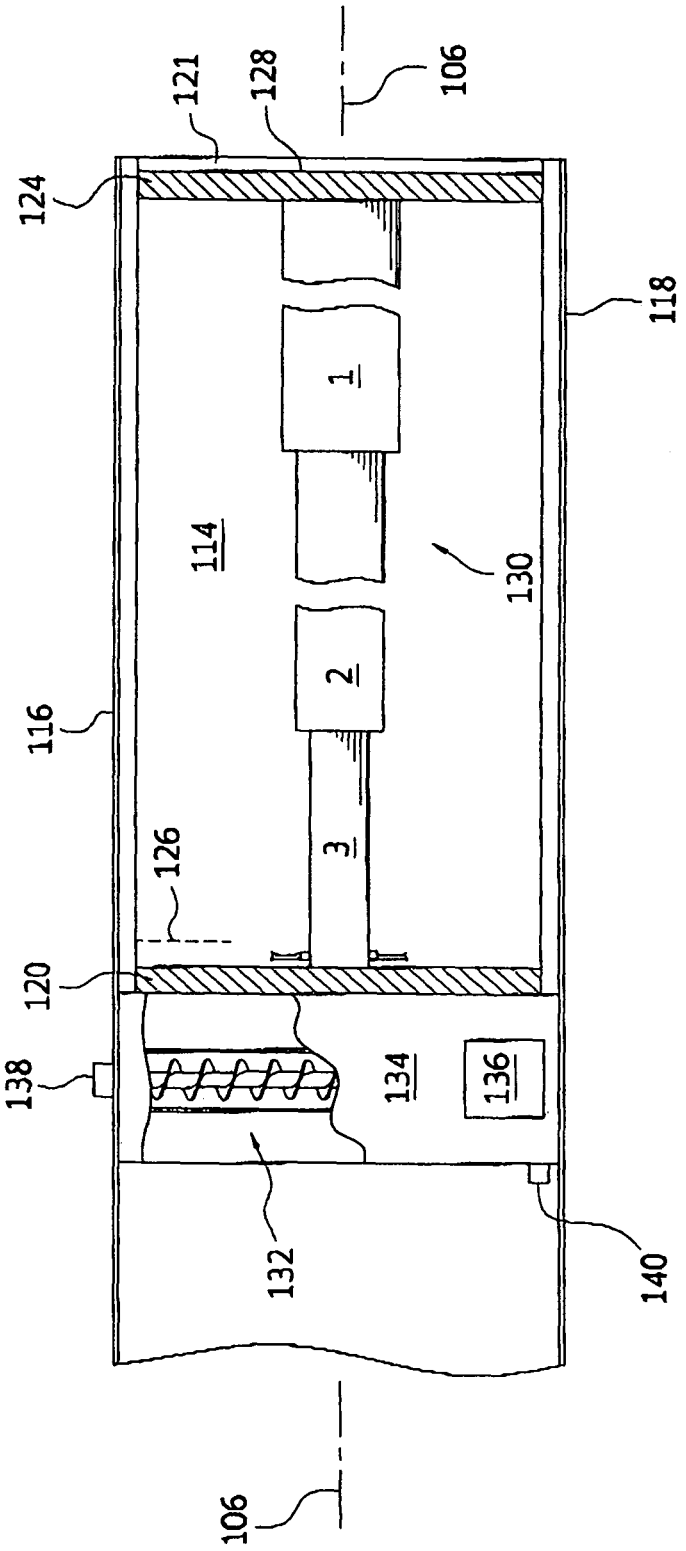
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FIG. 9

UTILITY MINE SCOOP AND MINE DUSTER

BACKGROUND OF THE INVENTION

This invention concerns a utility mine scoop machine with mine dusting capability, particularly for use in coal mines. The dusting aspect of the scoop can more effectively provide low levels of dust, e.g., limestone dust, of uniform densities or solids concentrations to the mine ventilation air currents for transportation thereby over substantial distances.

In underground coal mines, large amounts of coal dust are necessarily generated by the cutting, blasting, loading, crushing and the like of the coal. This dust not only is present in high concentrations at these sites but is carried by the mine ventilation air current from these sites, as well as from belt conveyor transfer point and locations along the belt conveyor where ventilation checks are installed, throughout the mines until it settles out on down stream surfaces. Such atmospheric dust, and settled-out dust accumulations are fire and explosion hazards and must be periodically cleaned up or made inert by addition of limestone rock dust.

There are several ways in which underground coal mines generate coal dust, (1) when the coal is cut from the coal seam, (2) when the coal is loaded into equipment that takes the coal to a feeder, (3) when the feeder crushes the coal, (4) when the feeder discharges the coal onto a conveyor belt and, (5) when the coal is discharged from one conveyor belt to the next conveyor belt.

This coal dust is carried by the ventilating air stream into the return ventilation air entries where it settles out in these entries and along the conveyor belt. The dust is also carried along the belt conveyor entries by the air stream in these entries.

Federal law requires that intake entries be 65% inert, and that return entries be 80% inert. Limestone dust is spread in the intake and return entries to get the needed percentages of inertness.

Federal law also does not allow coal dust to remain on top of surfaces underground. For example, an entry could have the percent inertness required but if coal dust is on top of the limestone dust and the entry is black with coal dust, a violation of federal law could be cited.

To keep the return entries and belt conveyor entries white, a limestone distributor called a Trickle Duster is typically employed as shown in U.S. Pat. No. 4,872,598 the disclosure of which is hereby incorporated herein by reference in it entirety. These dusters have an air blower and a tank that holds limestone (rock) dust. The blower discharge air goes into the tank typically up thru the limestone dust and fluidizes the dust. A small portion of the limestone dust is carried by the air stream and is continuously discharged into the entries. The trickle duster discharges a continuous fog of limestone dust that is carried by the ventilation air and helps to keep the return entries and conveyor belt entries white.

With reference to an alternative embodiment of trickle duster, anytime air is taken underground and is warmer than the underground ambient temperature (normally 50-55° F.), a condition of 100% humidity or so is present. In summer months, all surfaces in an underground coal mine are wet. The air that is blown into the limestone dust is at about 100% humidity and the limestone dust absorbs water during its fluidization which causes particles of the dust to become heavier and to stick together. When this limestone dust is discharged into the air stream entries, it will not travel as far and will not uniformly coat surfaces within the mine because it is wet and particles of the dust have agglomerated.

In one preferred embodiment of the present invention, the duster structure is shown in FIG. **1** in cross-section and delivers limestone dust and pressurized air to the mine entries rapidly whereby the dust will only be exposed to the high humidity air from the ambient air from a blower for a short period of time in the delivery hose as compared to prior dusters which are designed to form dust-in-air suspensions within the dust feed hopper apparatus. Employing this duster, limestone dust will travel a greater distance in the entries since it is dry and particles of dust will not be stuck together. This preferred duster employs an auger in the bottom of a vee bottom tank, an air blower and preferably with the addition of a vibrator on at least one sloped side wall to aide in dust movement to the auger and specially designed dust discharge structure which produces a substantially dry dust-in-air discharge stream. By mounting the duster on a battery powered scoop such as shown in FIGS. **5-7**, the duster can be transported within the mine, e.g., wherein the mine shaft is only 2 or 3 feet high, by commonly used scoop equipment to any location that the scoop equipment can go. This feature allows for total dust penetration throughout the mine. The motorized structure of the duster preferably is battery operated but can use any power source. Other commonly used dusters can be used, but the one shown in FIG. **1** is preferred.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be understood further from the drawings herein and their description wherein the figures are not drawn to scale or consistent proportions, and wherein:

FIG. **1** is an inside view (structures substantially in proportion) of the present preferred duster with the near side section removed and certain structures shown in cross-section;

FIG. **1**A is an enlarged cross-sectional view of the discharge section of the duster of FIG. **1**;

FIG. **2** is a cross-sectional view taken along line **2-2** in FIG. **1** with typical structural dimensions shown;

FIG. **3** is an end view of the hopper taken along line **3-3** in FIG. **1**;

FIG. **4** is a cross-sectional view of the discharge structure and adjacent hopper structure taken along line **4-4** of FIG. **1**;

FIG. **5** is a view of a typical utility scoop mining machine;

FIG. **6** shows views of the present duster arrangement on the scoop machine of FIG. **5**;

FIG. **7** is a view as in FIG. **6** showing the ejection jack and blade location;

FIG. **8** shows a conventional scoop machine carrying a load of mined coal; and

FIG. **9** is top view of the basic construction of the hydraulic jack, scoop and duster means.

DETAILED DESCRIPTION

Referring to the drawings the preferred trickle duster apparatus **10** comprises a base frame **12** which may be provided with wheels for easy transport, supports a dust hopper **14** formed with front **16**, rear **18**, side **20**,**22**, top **24** and bottom **26** wall sections forming a material feed chamber **28**, lower portions **30** of at least one of the side sections being slanted inwardly to form an auger well **32** having a longitudinal axis **34** running thru the front and rear wall sections.

A typical vibrator **21** useful with the present invention is the "Dayton" 2P Series 6L740 giving an adjustable force, e.g., 450 lbs. at 115/230 volts, single phase at 3600 RPM shown on page 234 of GRAINGER Catalog No. 402.

A dust discharge structure **36** preferably affixed to a mounting plate **15** has a front **38**, rear **40**, side **42**, **44**, top **46** and

bottom **48** wall means forming an auger discharge cavity **50** thru which axis **34** runs. This structure is mounted on front wall section **16** of the hopper via plate **15** with said rear wall means **40** of the discharge structure adjacent and sealed to front wall section **16**. An air inlet port **11** is provided on structure **36** and is adapted for connection to the exhaust **74** of blower **72**. A dust outlet port **52** on the discharge structure communicates with cavity **50**. Plate **15** preferably is welded or the like as at **78** to **40** and is preferably bolted as at **80** to **15** such that the discharge structure can be slid off of the auger should repairs be needed.

Affixed to the front wall means **38** of the dust discharge structure is a front bearing assembly generally designated **82** and comprising a sleeve member **84** having an inner end **86** formed as a retaining shoulder and having an outer end affixed to a bolt flange **88** as part of a packing gland. Within said member **84** is sealing packing **90**, bearing **92** and spacer washer **94**. Packing gland flange **96** is adapted to be pressured against bearing **92** and packing **90** by bolts **98**.

An auger **54** is provided having a shaft **56** supporting a flyght section **58**, said shaft having a drive end **60** and a front end **62** and is mounted axially in well **32** with the front end extending axially thru the front wall section **16** of the hopper and thru and beyond the rear **40** and front **38** wall means of the discharge structure. End **62** is axially rotatably supported by second bearing means **92** mounted on the front wall means of the discharge structure as described above. The drive end of the shaft extends thru the rear wall section of the hopper and is rotatably supported by first bearing means **64** located exteriorly of chamber **28**. A packing gland similar to that used for the front end **62** of shaft **56** receives the drive end **60** of the shaft and the equivalent parts of this gland to those at end **62** are numbered the same.

Flight section **58** has a rear end **66** and a discharge end **68**, said discharge end extending axially thru the front wall section **16** of the hopper and the rear wall means **40** of the discharge structure and opens within and is adapted to discharge into discharge cavity **50**. The rear end **66** of the flight section resides within the auger well. Motor **70** on the duster drives a speed reducer **76** which drives said auger. Dust seals **23** are provided.

Referring to FIGS. **1** and **7**, the access hatch cover **89** is provided with slots **91** into which pivot bolts **93** nest to allow nuts **95** to be tightened down against cover **89** and compress a dust seal **97**.

An air blower **72** (dotted line in FIG. **1**A) is mounted on either (a) the duster base frame **12** exterior to the hopper and has a blower exhaust **74** connected into inlet port **11** by hose **13** or equivalent means. This blower preferably is battery powered.

Following is an example of structural dimensions and operating parameters representing the best mode known to applicant for practicing the present invention.

(a) Hopper Capacity—700 lbs.
(b) Auger Shaft 2" Diameter 1.5 lbs/min.
(c) Auger Flight Diameter 2.44 in.
(d) Auger Pitch—2 in.
(e) Auger Speed—11 RPM.
(f) Auger Length—36 inch of Flight.
(g) Blower Mounted on Duster—50 to 60 CFM at 5 PSI, 5 HP ELEC. 1,800 RPM., Air filter in line to dust discharge cavity.
(h) Vibrator can produce 400 lbs of force.
(i) Vibrator is set at 300 lbs of force.
(j) A full hopper will run to empty in 8 to 10 hr.
(k) Blower air and dust mixed in discharge cavity and ejected to delivery hose at about 1.5 lbs. 1 per min.
(l) Delivery hose up to about 500 ft. long.
(m) Hopper is sealed by a top fill hatch cover.
(n) Pump type packing around auger shaft.

1) Once the pre-operational checks are made, remove the wing nuts from the hatch cover and lay the cover to the side.
2) Add up to 700 lbs of dry rockdust to the hopper, being careful not to introduce any foreign objects such as coal, slate or torn portions of the rockdust bag. Warnings: wet dust may cause the machine to malfunction.
3) Once the hopper is filled, replace the hatch cover and tighten all wing nuts.
4) Assure all by-standers are away from the discharge end of the dusting hose.
5) Press the motor start button on the control panel. This will start the motor and auger. The vibrator will have about a 2 minute delay, will run for 30 seconds, and then repeat the cycle until the machine is shut down. Note: The off-time and run-time of the vibrator can be adjusted. The recommended cycle is 2 minutes off and 30 seconds on. This allows the vibrator to cool.
6) Check the discharge end of the dusting hose to assure that a steady flow of dust is coming out of the hose. If dust is not flowing from the hose shut the machine down and refer to the trouble shooting portion of this manual.
7) Hang the hose as close to the mine shaft top as possible and down-stream of the duster. Point the hose in the direction of the air flow.
8) The duster will discharge up to 90 lbs per hour so the machine will empty in approximately 7-8 hours. When re-filling, de-energize before opening the hatch.
9) Up to 300 feet of 2" rockdust hose may be used. Using hose smaller than 2" or dusting distances more than 300 feet will lead to increased backpressure and will shorten blower life.

The preferred mine scoop machine comprises a body structure generally designated **100** having a front end section **102** and a rear end section **104**, said front end section having a longitudinal axis **106**, support wheels **108** on said front end section and steering wheels **110** on said rear end section, a material scoop **112** on said front end section of said body, said scoop having a bed portion **114**, upstanding opposing side portions **116**, **118**, and an upstanding rear wall portion **120**, said front end section being open at **121** to allow for insertion of said bed portion under a material load **122**, a load ejection blade **124** mounted on said scoop for movement longitudinally of said scoop between a load position **126** adjacent to said upstanding rear wall portion and a load ejection position **128** adjacent said open front end section, operator controlled power means piston **130** having telescoping sections **1**, **2** and **3** for moving said ejection blade selectively between said positions for loading and unloading said scoop, a mine dusting unit **132** mounted on said front end section of said body rearwardly of said load position of said ejection blade, said dusting unit comprising a dust hopper **134** having a ground rock material feed inlet port **136** a rock dust outlet port **138**, an air jet means **140** on said unit for fluidizing said ground rock material and ejecting the resulting rock dust out into a mine shaft.

The invention has been described in detail with particular reference to preferred embodiments thereof, but it will be understood that variations and modifications will be effected within the spirit and scope of the invention.

I claim:

1. A mine scoop machine comprising a body structure having a front end section and a rear end section, said front end section having a longitudinal axis, support wheels on said

front end section and steering wheels on said rear end section, a material scoop on said front end section of said body, said scoop having a bed portion, upstanding opposing side portions, and an upstanding rear wall portion, said front end section being open to allow for insertion of said bed portion under a material load, a load ejection blade mounted on said scoop for movement longitudinally of said scoop between a load position adjacent to said upstanding rear wall portion and a load ejection position adjacent said open front end section, an operator controlled power means for moving said ejection blade selectively between said positions for loading and unloading said scoop, a mine dusting unit mounted on said front end section of said body rearwardly of said load position of said ejection blade, said dusting unit comprising a dust hopper having a rear wall section a front wall section, a bottom wall section and side wall sections, and a top hatch cover, a rock dust transport auger having a shaft supporting an auger flight section is positioned in a lower portion of said hopper and extending outwardly through said front wall section and through rock dust discharge structure affixed to the exterior surface of said front wall section of said hopper, said discharge structure having an augered dust discharge cavity into which said auger extends and into which the augered dust is received, said discharge cavity having a dust outlet port and an air inlet port, a source of pressurized air is positioned external to said hopper and is connected into said air inlet port externally of said hopper, whereby the pressurized air will rapidly jet the dry dust out through said dust outlet port for transport to and through a mine dusting conduit without any significant exposure of the dust to ambient moisture.

2. The machine of claim **1** wherein a vibration means is affixed to said hopper for preventing dust agglomeration accumulation on the hopper walls.

3. The machine of claim **2** wherein said hopper is generally rectangular in lateral cross section and wherein each of said side wall sections include a lower portion, said lower portions of both side sections are slanted inwardly to form said an auger well.

4. The machine of claim **1** wherein a front end (**62**) of the auger shafts (**56**) is rotationally mounted in a front bearing assembly (**82**) comprising an axially oriented elongated structure sleeve having an aft end (**86**) affixed to a front wall means (**38**) of the dust structure **36**, and having a fore end containing a shaft end bearing (**92**) thru which the front end of the auger shaft is mounted, a seal packing is provided in the sleeve structure and surrounds a portion of the front end of the auger shaft, and a packing gland is provided on the fore end of the sleeve structure and is adapted to compress the seal packing (**90**) between the front wall means (**30**) of the discharge structure and a spacer washer (**94**) which separates the packing from the shaft end bearing.

5. The machine of claim **4** wherein the rear wall means of the discharge structure is affixed to a mounting plate which is removably affixed to said front wall section of said hopper.

6. The machine of claim **5** wherein said drive end of said shaft is mounted thru said packing gland which is affixed to said mounting plate which is removably affixed to said rear wall section of said hopper.

7. The machine of claim **1** wherein the source of pressured air is an air blower which delivers 50 to 60 CFM at 5 PSI, having an air filter in a blower exhaust line which line is connected by a hose means directly to said discharge structure.

* * * * *